

1N-90
386 490

TECHNICAL NOTE

D-1151

NEW INVESTIGATIONS OF THE ALLEGED METEORITE FROM IGAST, ESTONIA

John A. O'Keefe and Paul D. Lowman, Jr.

Goddard Space Flight Center
Greenbelt, Maryland

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON

December 1961

NEW INVESTIGATIONS OF THE ALLEGED METEORITE FROM IGAST, ESTONIA

by

John A. O'Keefe and Paul D. Lowman, Jr.
Goddard Space Flight Center

SUMMARY

This paper presents the results of a reinvestigation of the object which allegedly fell at Igast, Estonia, in 1855, and which may be the only example of a meteorite with the chemical composition of a tektite. It is concluded that generally quoted opinions of the artificial nature of this object are based on spurious samples, specifically melted brick and quartz basalt porphyry distributed by a Russian collector. Possibly genuine specimens from this observed fall are in the British Museum, the Paris Museum, and perhaps at the University of Dorpat, Estonia. It is recommended that these specimens be re-examined and that a search for similar objects be made.

CONTENTS

Summary	i
INTRODUCTION	1
HISTORY OF THE IGAST SPECIMENS	1
PRESENT INVESTIGATION	3
CONCLUSIONS AND RECOMMENDATIONS	3
ACKNOWLEDGMENTS	4
References	5

NEW INVESTIGATIONS OF THE ALLEGED METEORITE FROM IGAST, ESTONIA

by

John A. O'Keefe and Paul D. Lowman, Jr.
Goddard Space Flight Center

INTRODUCTION

The object which reportedly fell at Igast, Estonia, in 1855 may represent a totally new class of meteorite, possibly related to tektites. There has been no first-hand investigation of this material since the original report by C. Grewingk and C. Schmidt (Reference 1). This paper presents the results of an inquiry into the history and nature of the Igast object.

HISTORY OF THE IGAST SPECIMENS

Grewingk and Schmidt reported that the fall of the object had been witnessed by several observers whom they evidently considered reliable. The description of the fall is very similar to those of typical falls given by H. H. Nininger (Reference 2). "Two small handfuls" of material were recovered; one handful, five pieces with a total weight of 35.5 grams was submitted to Grewingk and Schmidt. They describe the material as brown and gray, vesicular, and containing clusters of quartz grains. No microscopic examination was made by them. The composition, as determined by an apparently careful analysis, is described in detail in Reference 1; the results are shown here in Table 1.

Shortly thereafter A. Goebel (Reference 3) obtained, in some manner, four pieces (total weight 485 grams) of what he claimed was the Igast object. At the same time he obtained a similar stone which he said was from another observed fall, date and place not stated, in Estonia. According to Grewingk (Reference 4), these stones passed into the possession of the Russian collector J. von Siemaschko of Saint Petersburg. Siemaschko listed (References 5, 6, 7, and 8) in several catalogues Igast specimens totaling several hundred grams which he offered for sale.

Table 1*

Composition of the Igast Object (5 gm used in analysis)

Substance	Percent of Weight
SiO ₂	80.87
Al ₂ O ₃	9.93
Fe ₂ O ₃ + FeO	2.45
MnO	0.20
CaO	0.75
MgO	1.58
K ₂ O	3.13
Na ₂ O	0.76
Loss on ignition	0.32
Total	99.99

*From Reference 9, page 482

At about this time, various other collections received portions of the Igast object. Included were the collections at the museums at Vienna (Reference 10), Paris (Reference 11), and Stockholm (Reference 12). In addition, the private collection of E. H. von Baumhauer at Harlem, The Netherlands (Reference 13), von Braun, Vienna (Reference 14), and Gregory, London (Reference 15), received specimens.

Very few of these specimens could have come from the original material submitted to Grewingk and Schmidt, since F. Loewinson-Lessing (Reference 16), Grewingk's successor, listed 15 grams of Igast material in the Dorpat collection in 1897, leaving only 5 grams of Grewingk's material unaccounted for (5 grams had been consumed in analysis).

At least some of the Stockholm collection reportedly came from Siemaschko, and some from Kotschubey, apparently another private collector in Saint Petersburg. The Vienna specimens may also have been from Siemaschko, since A. Brezina (Reference 10) refers to Siemaschko in connection with Igast.

Shortly after F. E. Suess (Reference 17) had put forth his ideas on the extraterrestrial origin of tektites, Brezina (Reference 18) drew attention to the resemblance between the chemical analyses of the Igast object and the tektites found in Bohemia and Moravia (moldavites). He also referred in the same paper to another apparent fall of acid rock, which he later (Reference 19) found to be artificial. He does not seem to have changed his opinion that the Igast object was natural.

In 1913, H. Michel (Reference 9) examined the Vienna Museum specimens of the Igast object, and concluded that they were either slag or brick. His paper includes a photograph of a hand specimen and a photomicrograph of a thin section.

PRESENT INVESTIGATION

In 1960, it became possible to reopen the investigation with the cooperation of Dr. A. Schiener of the Vienna Museum, who arranged the loan of a hand specimen and five thin sections for non-destructive examination. Dr. Schiener expressed his belief that the material was not meteoritic in the following paragraph:

"The investigation of the thin sections convincingly demonstrates the terrestrial origin of this somewhat unusual slag. There is absolutely no indication of a meteoritic source or of any similar origin."

The hand specimen is the same one examined by Michel. It weighs 47 grams and has a specific gravity of 2.50. Michel's opinion on the artificial nature of this specimen was confirmed when identical material was found at a local brickyard. Objects of this sort are apparently commonly formed by accidental melting during baking.

One of the thin sections, D1653, was from the hand specimen or material like it, and consists of a vesicular brown glass with occasional quartz grains. It strongly resembled a thin section made from the above mentioned melted brick. The quartz grains, which are found also in the hand specimen, were apparently mistaken by Michel for the quartz clusters described by Grewingk and Schmidt. Thin section D1653 was made after the year 1878, according to the maker's label.

The remaining four thin sections, J2203, J2204, J2205, and J2206, are evidently newer than D1653. All four are from the same material, which is not the hand specimen. Examination of the sections showed them to be from a fine-grained, vesicular brown porphyry. Rosiwal analysis gave the volumetric composition for the material as a whole as shown in Table 2.

In these newer sections many quartz crystals show corrosion and several of the plagioclase phenocrysts show zoning and reaction rims, with calcic interiors and more sodic exteriors. This material is best described as a quartz basalt porphyry. Dr. E. R. Roedder of the U. S. Geological Survey stated (personal communication) that it is not a slag; this opinion is supported by the typically igneous features found in the sections, as plagioclase zoning. Chemical composition could not be computed accurately without information on the exact composition of the plagioclase and pyroxene, but similar rocks from the Smithsonian Institution reference collection contain between 50 and 60 percent SiO_2 . The specific gravity of the material from which the four slides were made is probably not less than 2.4, including vesicles.

CONCLUSIONS AND RECOMMENDATIONS

In summary, it seems evident that neither the hand specimen nor the five thin sections labeled Igast in the Vienna Museum collection are identical with the material described by

Table 2

Rosiwal Analysis of Thin Sections (J2203-2206) of the "Ighost" Specimens
Owned by the Vienna Museum

Substance	Percent of Volume
*Plagioclase (An ₅₀ -An ₇₀)	40.1
*Pyroxene (probably augite; ZAC about 45°)	30.7
*Quartz	8.5
Magnetite	2.9
Glass	1.6
Vesicles (with and without filling)	16.1
Total	99.9

*Phenocrysts consist of plagioclase, pyroxene, and quartz: groundmass includes smaller crystals of the same minerals.

Grewingk and Schmidt. The hand specimen weighs more than all the material obtained by Grewingk and Schmidt, and is easily identified as artificial. The four thin sections not from the hand specimen contain less than 60 percent SiO₂, as compared with 80 percent for the original Ighost object.

It is concluded that the generally quoted opinions concerning the Ighost object are based on the examination of spurious objects distributed by Siemaschko. The specimen at the British Museum (Figure 1), received in 1864, is almost certainly genuine, as may be the specimen at Paris Museum. Some of the original find may still be at the University of Dorpat, Estonia. In view of the apparent reliability of Grewingk and Schmidt's account and the unusual composition of this "meteorite," it is suggested that further investigation of surviving specimens be carried out.

It is also suggested that museum collections of "pseudo-meteorites" be examined to see if Ighost-type material has been submitted from other locations. Additional discoveries of this sort would radically change present concepts of the origin of tektites.

ACKNOWLEDGMENTS

The authors are indebted to Dr. A. Schiener of the Vienna Museum and Mr. E. P. Henderson of the Smithsonian Institution for their assistance in obtaining this material. Thanks are also due to Mr. Grover Moreland of the Smithsonian Institution for preparing a thin section, and to the United Brick Company for access to their facilities.

D-1151

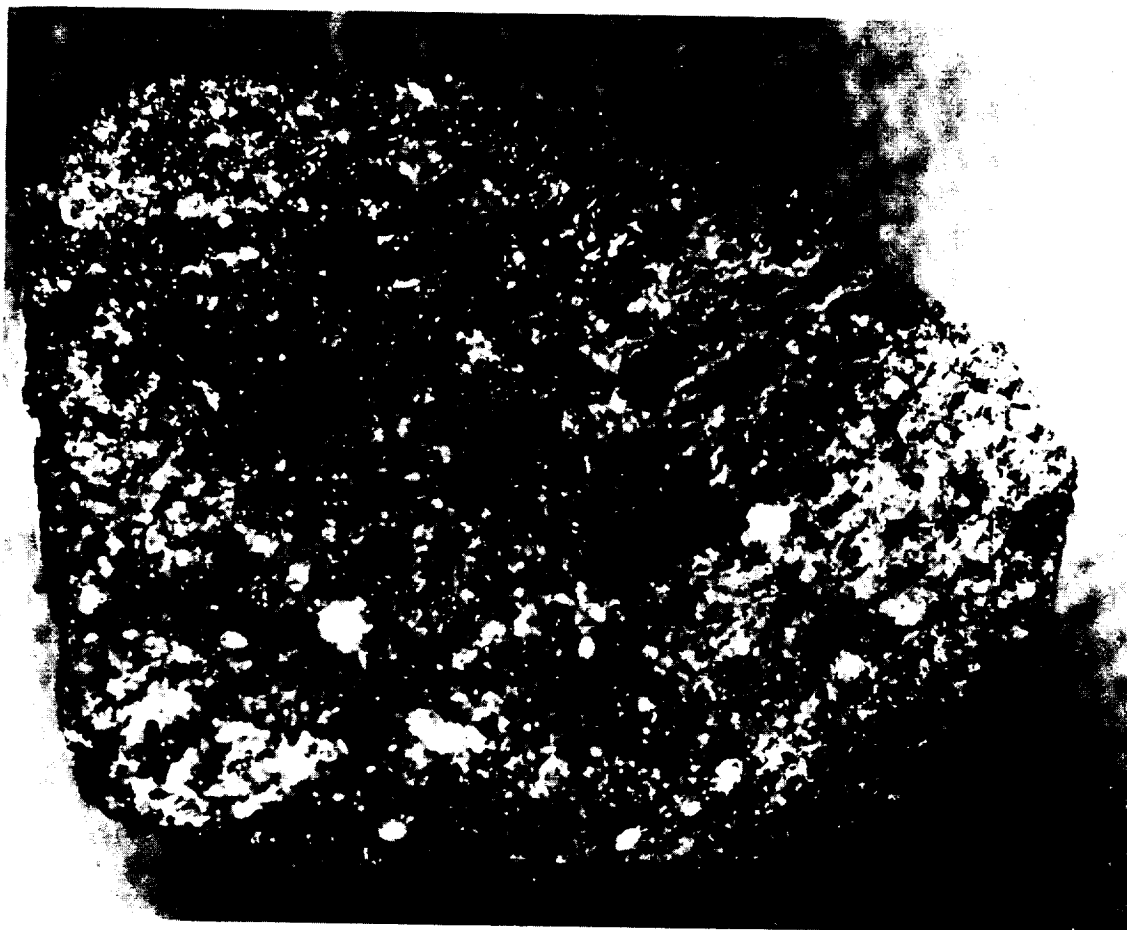


Figure 1 - Photograph (very approximately 4x) of the Igast specimen in the British Museum, taken by D. R. Chapman of NASA, Ames Research Center, through the courtesy of Dr. M. Hey

REFERENCES

1. Grewingk, C., and Schmidt, C., "Über die Meteoritenfälle von Pillistfer, Buschhof und Igast, in Liv-, Ehst- und Kurland," Archiv für die Naturkunde Livlands, Ehstlands und Kurlands 3, series 1: 421-553, 1864
2. Nininger, H. H., "Out of the Sky; the Story of Meteoritics," New York: Dover, 1959
3. Goebel, A. F., "Übersicht der in den Museen und Sammlungen von St. Petersburg vorhandenen Aerolithen," Bulletin de l'Académie Impériale des Sciences de St. Petersburg 11: 284-291, 527-555, 1867
4. Grewingk, C., "Verzeichniss der Meteoriten-Sammlung," Archiv für die Naturkunde Livlands, Ehstlands und Kurlands 9: 152-160, 1882

5. Siemaschko, J., "Die Meteoriten-Sammlung am 1. Januar 1881," St. Petersburg, 1881
6. Siemaschko, J., "Meteoriten-Sammlung," St. Petersburg, 1/13 April, 1882
7. Siemaschko, J., "Meteoriten-Sammlung von Julian v. Siemaschko," St. Petersburg, May 1885
8. Siemachko, J., "Catalogue de la collection de Météorites de Julien de Siemachko, St. Petersbourg, Russie," Paris, January 1886
9. Michel, H., "Zur Tektitfrage," Annalen des Kaiserlich-Königlichen Naturhistorischen Hofmuseum 27: 1-12, 1913
10. Brezina, A., "Die Meteoriten-Sammlung des K. K. Mineralogischen Hofkabinetes in Wien am 1. Mai 1885," Jahrbuch der Kaiserlich-Königlichen geologischen Reichsanstalt, Wien 35: 151-276, 1885
11. Meunier, S., "Guide dans la Collection de Météorites du Muséum d'Histoire Naturelle," Paris: G. Masson, 1889
12. Lindström, G., "Förteckning öfver Riksmusei Meteoritsamling," Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar No. 9, Stockholm, 1884
13. Anonymous, "Collection de Pierres et Fers Météoriques du Professor E. H. von Baumhauer à Harlem," March 1882
14. Anonymous, "Meteoriten-Sammlung des Freiherrn von Braun," Vienna, January 1882
15. Gregory, J. R., "Catalogue of the Collection of Meteorites of James R. Gregory of London," London, 1889
16. Löewinson-Lessing, F., "Catalogue de la Collection de Météorites de l'Université Impériale de Jourieff (Dorpat)," Uchenyye zapiski Imperatorskogo Yur'yevskogo universiteta 5, supplement 2: 1-18, 1897
17. Suess, F. E., "Über den Kosmischen Ursprung der Moldaviten," Verhandlungen der Geologische Kaiserlich-Königliches Reichsanstalt, Wien: 387-403, 1898
18. Brezina, A., "Über Tektite von beobachteten Fall," Anzeiger der Kaiserlichen Akademie der Wissenschaften 41(5): 41-44, 1904
19. Simpson, E. S., "Note on an Australite Observed to Fall in Western Australia," Journal of the Royal Society of Western Australia 21: 37-38, 1935

